Adverse Selection and Loss Coverage in Insurance Market

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Mingjie Hao PhD student in Actuarial Science, University of Kent

Pradip Tapadar (1st): Senior lecture in Actuarial Science, University of Kent

Guy Thomas (2nd): Honorary Lecturer in Actuarial Science, University of Kent

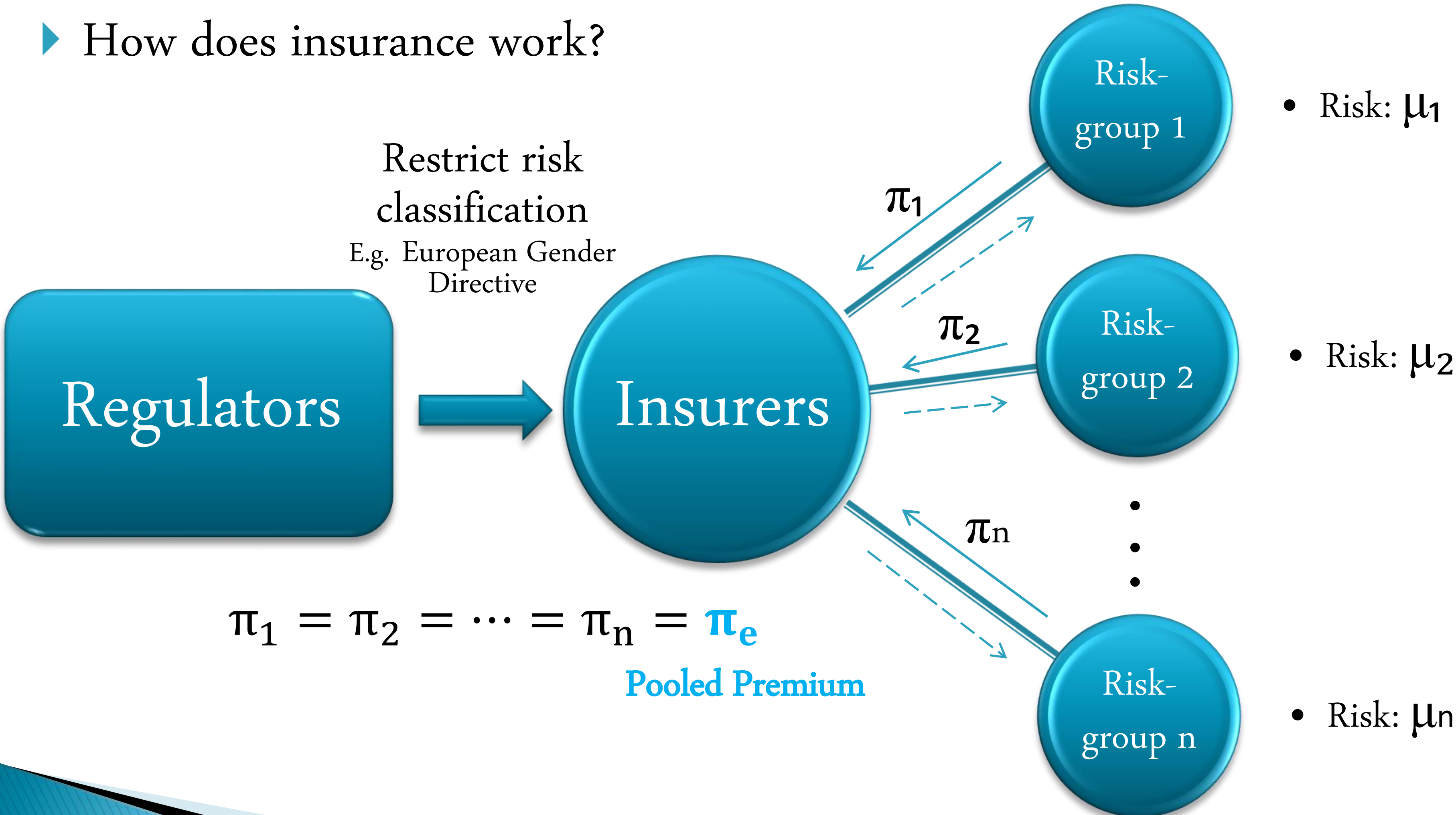
Angus Macdonald (external): Professor in Actuarial Science, Heriot-Watt University

Agenda

- Background
- Adverse selection
- Loss coverage
- Iso-elastic & negative-expoenetial demand functions
- Results on loss coverage and adverse selection
  - Special case: equal demand elasticity
- Summary
- References

Background

- How does insurance work?



Adverse Selection

$0 \quad \pi_1 \quad \pi_2 \quad \pi_3 \quad \pi_e \quad \pi_4 \ldots \pi_6 \quad \pi_7 \ldots \pi_n \quad 1$

- Purchasing decision is positively correlated with loss
  - Chiappori and Salanie (2000) "Positive correlation test"
- Empirical results are mixed and vary by market

Life insurance	Cawley and Philipson (1999)	X
Auto insurance	Chiappori and Salanie (2000)	X
	Cohen (2005)	O
Annuity	Finkelstein and Poterba (2004)	X
Health insurance	Cardon and Hendel (2001)	X

- Over-subscribed by high risks *BAD?*
- Model:

$$\mathbf{S} = \frac{\mathbf{E[QL]}}{\mathbf{E[Q]E[L]}}$$

Q: quantity of insurance

L: risk experience

- A moderate degree of adverse selection can be ***GOOD!***

Loss Coverage

- High risks most need insurance.
  ↳ Ban on risk classification is reasonable.
- Thomas (2008, 2009) "loss coverage":

  proportion of the whole population's expected losses compensated by insurance

$$\text{Loss coverage} = \frac{\text{insured expected losses}}{\text{population expected losses}}$$

$$\text{Loss coverage ratio} = \frac{\text{loss coverage at a pooled premium } \pi_e}{\text{loss coverage at fair premium } \pi_i} > 1$$ *GOOD!*

- Example:
  - A population of 1000 with 2 risk-groups
    - 200 high risks with risk 0.04
    - 800 low risks with risk 0.01
    - No moral hazard

Loss Coverage

Table 1: Full risk classification

	Low risk-group	High risk-group
Total population	800	200
Risk	0.01	0.04
Break-even premiums (fair premium)	0.01	0.04
Numbers insured:	400	100
Insured losses	4	4
Loss coverage:	0.5	
Loss coverage ratio	1	

No adverse selection

Loss Coverage

Table 2: Risk classification banned: moderate adverse selection

	Low risk-group	High risk-group
Total population	800	200
Risk	0.01	0.04
Break-even premiums (pooled premium)	0.02	
Numbers insured:	300 (400)	150 (100)
Insured losses	3	6
Loss coverage:	0.5625	
Loss coverage ratio	***1.125 > 1***	

Higher loss coverage

Loss Coverage

Table 3: Risk classification banned: severe adverse selection

	Low risk-group	High risk-group
Total population	800	200
Risk	0.01	0.04
Break-even premiums (pooled premium)	0.02154	
Numbers insured:	200 (400)	125 (100)
Insured losses	2	5
Loss coverage:	0.4375	
Loss coverage ratio:	***0.875 < 1***	

Lower loss coverage

Demand functions

Name	Iso-elastic	Negative-exponential
Demand function	$d_i(\pi) = P_i \tau_i [\frac{\pi}{\mu_i}]^{-\lambda_i}$	$d_i(\pi) = P_i \tau_i \exp[\left(1 - \frac{\pi}{\mu_i}\right)\lambda_i]$
Demand elasticity function $\varepsilon_i(\pi) = -\frac{\pi}{d_i(\pi)}\frac{\partial d_i(\pi)}{\partial \pi}$	λ_i	$\frac{\lambda_i}{\mu_i}\pi$

For simplicity, we assume

- there are only two risk groups i=1,2;
- they have equal demand elsticity
  - Iso-elastic demand function: $\lambda_1 = \lambda_2 = \lambda_0$
  - Negative-exponential demand function: $\frac{\lambda_1}{\mu_1}\pi_e = \frac{\lambda_2}{\mu_2}\pi_e = \lambda_0$

Loss Coverage
-equal demand elasticity

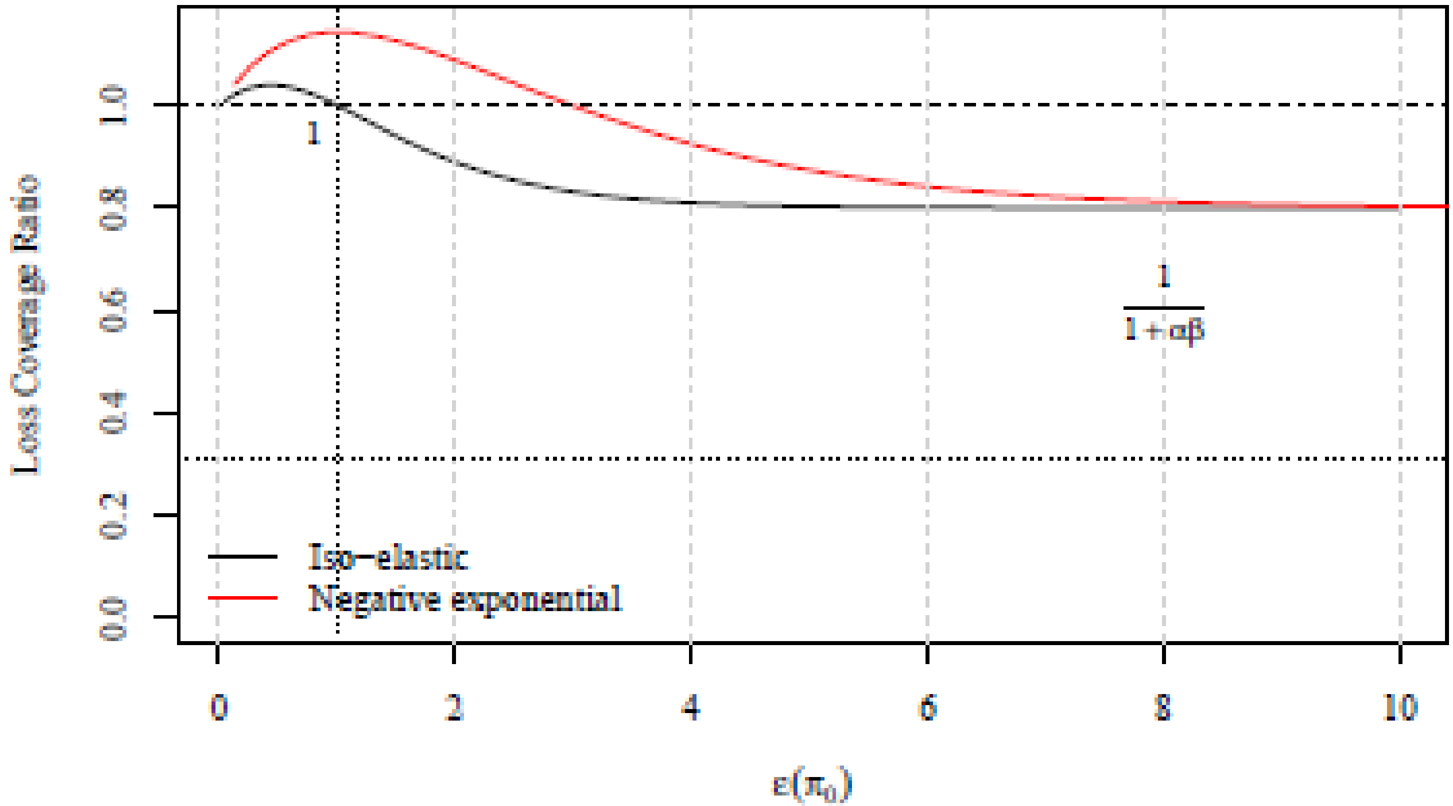


Figure 1: Plot of loss coverage for $P_1 = 9000, P_2 = 9000, \mu_1 = 0.01, \mu_2 = 0.04$

Adverse Selection

-equal demand elasticity

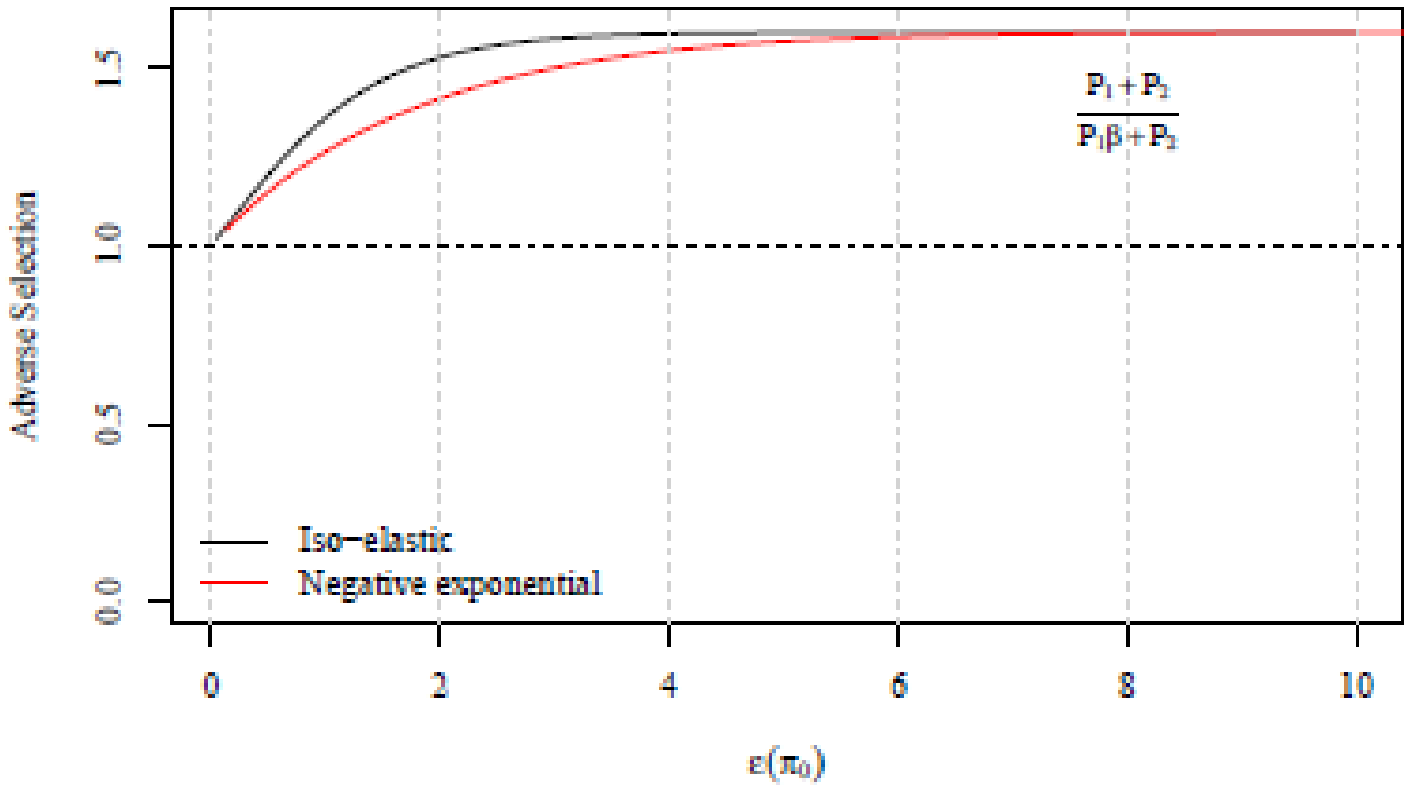


Figure 2: Plot of adverse selection for $P_1 = 9000, P_2 = 9000, \mu_1 = 0.01, \mu_2 = 0.04$

Summary

- We model the outcome in an insurance market where a pooled premium is charged for two risk-groups when there is an absence of risk classification.
- Using iso-elastic & negative-exponential demand functions,

  ↳ loss coverage will be increased if a degree of adverse selection is tolerated. I.e. adverse selection is not always a bad thing.
- Further research should be carried out in more general cases
  - Other demand functions e.g. $d_i(\pi) = P_i \tau_i \exp[1 - \left(\frac{\pi}{\mu_i}\right)^{\lambda_i}]$
  - No restriction on demand elasticity
  - Various risk-groups

References

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Questions?

Thank you!